Monthly Vital Statistics
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Focus. . .Missouri Prenatal WIC Participation and Pregnancy Outcomes

The Special Supplemental Nutrition Program for Women, Infants and Children (WIC) is the largest public health program in Missouri directed towards improving the health of prenatal and postpartum women, along with newborns and young children who are nutritionally at risk. WIC is a nationwide program funded by the U.S. Department of Agriculture to provide nutrition education for low-income women and children, and vouchers for the purchase of supplemental foods which are rich in protein, iron and key nutrients. WIC also refers participants to other needed services such as prenatal care and well child care.

A number of studies1,2,3 have found a positive association between prenatal WIC participation and birth outcomes. The present study is an update to 1980 and 1982 studies of the relationship of WIC prenatal participation and pregnancy outcomes in Missouri 2,3 to see if the results still prevail. The major differences between this and the previous studies are that:

The current 1994 study population of 29,173 is over three times larger than the 1982 and over four times larger than the 1980 WIC study population.

The large percentage of at-risk mothers in WIC necessitated a different type of control group than was used for the previous studies. The1994 non-WIC population did not consist of enough women with similar distributions of age, race, marital status and education to permit random frequency matching as was used for the prior studies.

The cutoff participation level for WIC in 1980, 1982 and 1994 were 195, 175 and 185 percent of the Federal Poverty level, respectively.

An attempt is made to address prematurity bias; whereas the prior studies did not address this issue.
The major questions this study addressed include:

- Is the outcome of pregnancy associated with WIC participation?
- Is length of WIC participation associated with the outcome of pregnancy?

Methods

The study population consisted of Missouri resident WIC prenatal participants delivering in 1994. During 1994, the WIC program covered all 114 Missouri counties and the City of St. Louis. Information on WIC participants was acquired from an extracted WIC master data set that covered all prenatals with expected dates of delivery (EDD) between October 1993 and June 1995. Months before and after the study year of 1994 were included because of preterm and postterm births and otherwise incorrect EDD values. The WIC prenatals were linked with the WIC postpartum and WIC infants data sets using the department client identification number. This was done to acquire infant's name and date of birth for cases where there was a link.

The resultant WIC data set was linked with the 1994 birth/fetal death certificates and the linked birth/death data sets using names, dates of birth and mothers' Social Security Numbers along with other identifying information (e.g. resident county, race, street address) used to establish clear links, where needed. Overall, 89.7 percent of the WIC prenatal certification records were linked with their corresponding birth/fetal death certificates. The linked file represented 39.8 percent of Missouri 1994 resident deliveries. Because of multifetal pregnancies (e.g. twins, triplets) these linked records represented 29,342 pregnancy outcomes; with 29,173 live births and 169 fetal deaths. The linking success was similar for black and white mothers (91.5 vs 89.4 percent); and marital status, with 90.6 percent for married and 89.5 percent for single women. The state's most populated areas, St. Louis

County, St. Louis City and Jackson County, had linking rates of 93.8, 91.7 and 89.6 percent, respectively. For the rest of Missouri, only three rural counties had rates just below 80 percent.

The Missouri birth/fetal death certificate has an item asking if the mother participated in WIC during her pregnancy. All unlinked birth/fetal death certificates noting a 'yes' for this item were deleted from the non-WIC population to reduce the likelihood of a WIC participant inclusion in the non-WIC group.

The population of non-WIC births includes a large percentage (47.5percent)of women not having identifiable characteristics that would permit their entry into WIC (e.g. age less than 18, over 34, gain less than 20 pounds at term, prepregnancy weight 10 percent or more under desired weight for height). Also, over three-fourths of WIC participants not having any of these factors identifiable from the birth certificate were on WIC for inadequate diet as determined from 24 hour recall. To better equate the two groups, it was decided to include only WIC and Non-WIC participants having one or more of the WIC criteria for eligibility identifiable from the birth certificate.4 To further equate the two groups socioeconomically, only Medicaid participants were included. Even with these restrictions, differences in WIC/Non-WIC remained and thus needed to be controlled statistically.

Prematurity bias occurs when program effects are greater with increasing degrees of prematurity due to some women having a preterm birth prior to their chance to get on the program. This results in the potential for poor birth outcomes falling disproportionately in the non-program group. Also, a short length of program participation may be caused by a preterm delivery. Exclusions introduced to partially reduce prematurity bias were: 1) WIC records noting WIC entry in the third trimester, and 2) women in both groups starting prenatal care in the third trimester or not at all. The above exclusions resulted in a final study file with 11,501 WIC participants and 2,913 Non-WIC participants. Even though these exclusions have resulted in much smaller files than the original files; they are more similar to each other on identifiable risfactors, and therefore, should provide a better test for the effects of WIC participation.

In order to statistically control for differences that still existed between the WIC and non-WIC groups with risk factors identifiable from the birth certificate, logistic regression was used. Utilizing just those variables that were significant at or beyond the 0.10 level in the model for low birth weight resulted in the following risk factors being controlled for: plurality, smoking during pregnancy, underweight for height, medical/pregnancy complications, and race for all races models. Race was defined as black and white,with the white group composed of over 97 percent white and the remainder non-black minorities.

Duration on WIC was defined as the proportion of pregnancy that a participant utilized WIC, or the length of WIC participation during pregnancy divided by length of gestation in weeks times 100. This was further divided into three groups: a) less than 1/3, 1/3 to 2/3, and over 2/3 of pregnancy on WIC. It is believed that the above approach helped reduce the prematurity bias.

The WIC Certification record provided information on who was on WIC and the duration of participation. The birth/death certificates provided a common source for identifying pregnancy outcomes, and socio-demographic, behavioral and medical factors for the WIC and non-WIC groups.

Results

Table 1 provides the overall as well as the racial comparisons of WIC vs non-WIC participants on selected adjusted pregnancy outcome measures along with their crude rates. The odds ratio (OR) for LBW is significantly reduced to 0.87 for WIC participants with an even lower OR of 0.78 noted for blacks on WIC. The corresponding OR of 0.92 for white WIC participants was not significantly different from 1.0. The ORs associated with infant deaths (deaths during the first year of life) were low (0.77, 0.84 and 0.66 for overall, white and black WIC participants respectively); however, they were not significantly different from 1.0. WIC participants had significantly reduced ORs for inadequate prenatal care for term births with values of 0.52, 0.51 and 0.54 for overall, white and blacks, respectively. Adjusted ORs associated with small-for-gestational-age, fetal deaths and weight gain of less than 20 pounds for term births were not discernible from 1.0.

For prenatal WIC participants delivering in 1994, the mean duration of participation was 5.0 months; with durations of 5.2 and 4.6 months observed for white and black participants respectively. A significant reduction in LBW was noted for those cases where WIC participation was two-thirds or more of their pregnancy. Adjusted LBW ORs and confidence intervals of 0.70 (0.61-0.82), 0.79 (0.66-0.95) and 0.54(0.41-0.71) were noted for overall, white and black WIC participants, respectively. However, if just term LBW are reviewed, only black WIC participants have significant adjusted LBW OR (0.59, 0.39-0.90). The only other duration of pregnancy on WIC to approach significance was for those on between one- and two-thirds of their pregnancy for black WIC participants with an adjusted LBW OR of 0.88 (0.70-1.12).

Discussion

As with most prior studies, small, though statistically significant gains are noted for LBW (OR 0.90) with positive results being most evident for black WIC participants. This was also the case for the corresponding 1980 and 1982 Missouri WIC studies2,3 where differences were also small and most evident for black WIC participants. The 1980 WIC study had a LBW differential of -0.9 (8.5 vs. 9.4percent), 1982 study -1.5 (7.7 vs. 9.2percent), and the present study LBW differential of -1.4 (11.6 vs. 13.0 percent).

The results of this study could be influenced by selection bias in that WIC participants could be more motivated to have healthy babies than non-WIC participants. Evidence for this is the fact that WIC participants had significantly lower adjusted inadequate prenatal care ORs. However, including inadequate prenatal care in the logistic regression model for LBW did not change the results. Also, some WIC participants received adequate prenatal care because of being referred from WIC agencies. For both groups all records with care starting after the second trimester and those with no care were excluded.

A duration of over two-thirds of pregnancy on WIC was needed before a reduction in LBW was realized and if just term births were reviewed, the gain was only evident infants of black WIC participants. Because only women entering WIC prior to their third trimester of pregnany were included in the study, and for both groups only women starting prenatal care prior to their third trimester are included, the threat of prematurity bias influencing the results should be dampened though it is still a problem. The mean gestational age associated with a 2500 gram birth is 37 weeks; well into the third trimester.

Most likely one of the key reasons for the weak overall LBW result is the fact that over 44 percent of those WIC participants who went to term participated in WIC for less than two-thirds of their pregnancy. These results point to the need for increased outreach efforts at enrolling women into WIC early in their pregnancy to manifest WIC's greatest potential.

References:

1Missouri Monthly Vital Statistics. WIC Cost/Benefit Analysis 1994. Vol.31, No.4, June 1997.

2Stockbauer, J.W., Evaluation of the Missouri WIC program: Prenatal component. J Am Dietet Assoc 1986; p 86:61-67.

3Stockbauer, J.W., WIC Prenatal Participation and Its Relation to Pregnancy Outcomes in Missouri: A Second Look. Am J Public Health July 1987; 77:7, 813-818.

4Listing of WIC criteria identifiale from the birth certificate is available from theBureau of Health Data Analysis.

Table 1
WIC/Non-WIC Comparisons for Selected Outcome Measures by Maternal Race:
1994 Missouri Resident Data

All Races			*White*			*Black*		
Crude Rates		*Adjusted*	*Crude Rates*		*Adjusted*	*Crude Rates*		*Adjusted*
WIC	*Non-WIC*	*OR CI*	*WIC*	*Non-WIC*	*OR CI*	*WIC*	*Non-WIC*	*OR CI*

Low Birth Weight	11.7	13.2	0.87*	0.76-0.99	10.7	10.8	0.92	0.77-1.09	14.5	18.8	0.78*	0.62-0.97
n	1,333	382			910	217			423	165		
Term LBW	5.8	5.6	1.02	0.83-1.24	5.6	4.8	1.11	0.87-1.43	6.5	7.8	0.83	0.59-1.16
n	585	138			425	85			160	53		
Small-for-gestational age	14.6	15.2	0.95	0.84-1.07	15.4	16.1	0.95	0.83-1.09	12.3	13.3	0.95	0.75-1.20
n	1,676	444			1,314	326			362	118		
Weight gain less than 20 lbs. for term birth	25.6	23.1	1.11	0.99-1.24	25.0	21.9	1.10	0.97-1.26	27.3	26.3	1.10	0.90-1.34
n	2,574	566			1,903	387			671	179		
Infant deaths	11.0	14.4	0.77	0.53-1.10	10.4	11.9	0.84	0.53-1.32	12.6	20.2	0.66	0.36-1.20
n	126	42			89	24			37	18		
Fetal deaths	6.0	7.2	0.99	0.57-1.71	4.9	4.9	0.97	0.47-2.02	9.4	12.2	0.93	0.40-2.19
n	70	21			42	10			28	11		
Inadequate prenatal care term only	16.1	27.5	0.52*	0.46-0.57	13.3	23.3	0.51*	0.45-0.58	24.7	38.6	0.54*	0.45-0.64
n	1,619	674			1,013	411			606	263		

*Significantly lower than 1.0 at the 0.05 level.

n-number of outcome events (low birth weight infants, etc.)

Odds ratios are adjusted for number born (single birth vs. twins, etc.), smoking during pregnancy, medical/pregnancy complications, underweight for height (10% or more vs. other), for height and race for the all races model.

Table 2
WIC/Non-WIC Comparisons for Crude LBW and Term LBW Rates and Adjusted Odds Ratios by Proportion o f Pregnancy on WIC and Maternal Race

Proportion of	*Term Low Birth Weight*											
Pregnancy	*All Races*				*White*				*Black*			
on WIC	*Crude Rates*		*Adjusted*		*Crude Rates*		*Adjusted*		*Crude Rates*		*Adjusted*	
	WIC	*Non-WIC*	*OR*	*CI*	*WIC*	*Non-WIC*	*OR*	*CI*	*WIC*	*Non-WIC*	*OR*	*CI*
Greater than 2/3	5.2	5.6	0.89	0.72-1.11	5.3	4.8	1.03	0.80-1.34	4.8	7.7	0.59*	0.39-0.90

	n 291	144			241	90			50	54		
1/3-2/3	6.4		1.13	0.91-1.40	5.8		1.17	0.89-1.53	7.8		1.03	0.72-1.48
	n 279				174				105			
Less than 1/3	11.8		1.96	1.08-3.56	14.9		2.79	1.33-5.83	8.3		0.99	0.34-2.88
	n 15				10				5			
- *Low Birth Weight* -												
Greater than 2/3	9.7	13.2	0.70*	0.61-0.82	9.5	10.9	0.79*	0.66-0.95	10.5	18.7	0.54*	0.41-0.71
	n 600	405			473	234			127	171		
1/3-2/3	12.8		0.94	0.82-1.09	11.3		0.98	0.81-1.18	15.9		0.88	0.70-1.12
	n 642				386				256			
Less than 1/3	40.8		3.65	2.68-4.99	43.9		4.69	3.07-7.17	37.5		2.63	1.65-4.18
	n 102				57				45			

*Significantly lower than 1.0 at the 0.05 level.

n-number of low birth weight infants

Odds ratios are adjusted for number born (single birth vs. twins, etc.), smoking during pregnancy, medical/pregnancy complications, underweight for height (10% or more vs. other), and race for the all races model.

Provisional Vital Statistics for December 1997

Live births increased sharply in December as 6,903 Missouri infants were born compared with 4,399 born one year earlier. Irregular reporting is the primary reason for this sharp increase.

Cumulative births for the 12 months ending with December shows a slight increase from 73,733 to 74,581.

Deaths increased in December as 5,100 Missourians died compared with 4,745 in December 1996. Cumulative deaths for the 12 months ending with December indicate a possible record high death total in 1997.

The **Natural increase** in December was 1,793 (6,903 births minus 5,110 deaths). Cumulative natural increase for the 12 months ending with December show no change in the rate, 3.7 per 1,000 population.

Marriages and **Dissolutions of marriage** both decreased in 1997 as 43,585 Missouri couples married and 25,257 divorced. Marriages are at the lowest point in 30 years while dissolutions of marriage are at the lowest level in 8 years..

Infant deaths remained at approximately 7.6 per 1,000 live births, about the same as in 1996.

PROVISIONAL RESIDENT VITAL STATISTICS FOR THE STATE OF MISSOURI

December

12 months ending with December

Item	Number		Rate*		Number				Rate*				
	1996	1997	1996	1997	1994	1995	1996	1997	1993	1994	1995	1996	1997
Live Births	4,399	6,903	9.1	15.0	73,279	72,804	73,733	74,581	14.4	13.8	13.7	13.7	13.8
Deaths	4,745	5,110	9.8	11.1	53,611	54,222	53,766	54,838	10.3	10.1	10.2	10.0	10.2
Natural increase	2,158	1,793	4.5	3.9	19,668	18,582	19,967	19,743	4.1	3.7	3.5	3.7	3.7
Marriages	3,292	3,023	6.8	6.6	45,070	45,057	44,473	43,585	8.5	8.5	8.5	8.3	8.1
Dissolutions	2,214	2,213	4.6	4.8	26,441	25,726	25,438	25,257	5.1	5.0	4.8	4.7	4.7
Infant deaths	45	43	10.2	8.1	597	539	558	566	8.4	8.1	7.4	7.6	7.6
Population base (in thousands)	...	...	5,323	5,352	...	...	...	...	5,238	5,281	5,325	5,364	5,402

*Rates for live births, deaths, natural increase, marriages and dissolutions are computed on the number per 1000 estimated population. The infant death rate is based on the number of infant deaths per 1000 live births. Rates are adjusted to account for varying lengths of monthly reporting periods.

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